Interstate Highway System Pavement Distress Survey Results

REGIONS 1 - 10

LIBRARY
N.Y.S. Dept. of Transportation
Engineering R&D Bureau
State Campus, Bldg. 7A/600
1220 Washington Avenue
Albany, NY 12232

TECHNICAL SERVICES DIVISION
NEW YORK STATE DEPARTMENT OF TRANSPORTATION
Mario M. Cuomo, Governor/Franklin E. White, Commissioner

INTERSTATE HIGHWAY SYSTEM
PAVEMENT DISTRESS SURVEY RESULTS

REGIONS 1 - 10

August 1987

PAVEMENT MANAGEMENT SECTION
TECHNICAL SERVICES DIVISION
New York State Department of Transportation
State Campus, Albany, New York 12232

CONTENTS

I. INTRODUCTION 1

II. PAVEMENT EVALUATION METHOD 2

A. Pavement Distress Survey 2
B. Definition of Highway Section 2
C. Treatment Analysis 3

III. SURVEY FINDINGS 4

A. Overview -- Regions 1 through 10 5
B. Regional Comparisons 10

IV. USE OF THE 1986 INTERSTATE SURVEY RESULTS 16

ACKNOWLEDGMENTS 18

APPENDICES

A. Pavement Distress Survey Scales
B. Highway Section Report
C. Work Summaries By Route and By Region

NYSDOT
Library
50 Wolf Road, POD 34
Albany, New York 12232

I. INTRODUCTION

In 1983, the Department became interested in developing a pavement management system based on pavement distresses and engineering analyses of treatment needs. The Highway Management Committee -- comprised of the deputy commissioner and the assistant commissioners of administration and finance, engineering, operations, and public transportation -- provided the direction. The committee asked the Pavement Management Task Force to evaluate the Department's current survey methods and analytical procedures against state-of-the-art practices. Task force findings and recommendations are contained in their report, Highway Management Information Needs and Data Collection Requirements, dated December 1984. Based on these findings, the Highway Management Committee directed the Technical Services Division to develop a network-level pavement-distress survey, and to demonstrate its capabilities on the Interstate Highway System.

A network-level pavement-distress survey was developed and implemented in the fall of 1986 on more than 850 miles -- 1700 miles (both directions) -- of Interstate in Regions 1 through 10. Raw distress data produced by the survey were merged by the Data Services Bureau in the Planning Division with the Highway Sufficiency file to capture available inventory data. A methodology for interpreting survey data into treatment actions was developed by the Technical Services Division, along with microcomputer software incorporating this methodology.

The results of the 1986 Interstate Survey for Regions 1 through 10 are reported herein. Tables and figures present summary information on the class of work, amount, and cost needed for pavement and shoulder repairs. The summary information is derived from detailed distress assessments made at tenth mile intervals using the Pavement Distress Survey. Assessments are first evaluated for individual highway sections, determined principally by original construction limits, to produce Highway Section Reports. Highway section evaluations in these reports are then summarized in various formats to create regional reports and this summary report for the ten regions. Highway Section Reports and regional summaries can be found in separately published regional reports.

II. PAVEMENT EVALUATION METHOD

Pavement condition can be expressed in terms of distress, roughness, friction, and strength. The Technical Services Division report, Highway Management Information Needs and Data Collection Requirements, dated December 1984, concludes that measurement of pavement distress is most useful for estimating work needed to correct pavement deficiencies. Pavement distress indicates that the limits of material properties have been exceeded under load (traffic, temperature, etc.). Distress characteristics also give clues to the mode of failure and possible causes. Deterioration rates are more precise, and consequently predictable if related to patterns of distress development. Relationships between deterioration rates and various engineering factors (traffic, pavement thickness, level of maintenance, materials quality, etc.) can then be determined. Finally, cost-effective pavement maintenance treatments can be developed and applied.

A. Pavement Distress Survey

The Pavement Distress Survey is subjective in evaluating pavement surface condition at the network level. A three-person crew continually evaluates the driving lane and outside shoulder from a slow moving van traveling the shoulder. Assessments are recorded every tenth mile. No physical measurements are taken.

Surface condition is assessed in terms of distress type, severity, and extent. Abbreviated distress scales are included in Appendix A. The scales are listed by distress type for each of the two pavement categories, rigid and overlay/flexible, and for shoulders. Distress attributes associated with severity are listed under the heading "severity." Extent descriptors are listed under the heading "extent." Rating codes corresponding to distress levels are in the column "level." For additional information on the Pavement Distress Survey refer to NYSDOT's Manual for Rating Pavement Distress on the Interstate System.

B. Definition of Highway Section

"Highway section" refers to a length of pavement and shoulder having uniform characteristics for evaluation purposes. The Pavement Distress Survey records distress assessments every tenth mile. However, most people are interested in highway sections having length that has significance -- for example, a length that may constitute a design, construction, or maintenance project.

Highway sections, therefore, are created by subdividing Interstate routes by state highway number. This approach is sound from an engineering point of view:

1. Original contract limits are preserved (same contractor),

2. Design and construction variables are normalized,

3. Traffic loadings are generally constant,

4. Maintenance of traffic considerations may dictate similar construction limits if repairs are necessary, and

5. Exposure to the environment (soils, temperature, etc.) is constant.

To address other significant considerations, highway sections must be further subdivided on pavement type and county. Pavement type is necessary to evaluate portions of rigid pavements which have been overlaid. County is included so survey results could be summarized on a regional basis.

In summary, highway sections serve as the basic unit for presenting survey data and performing pavement evaluations. They are determined by subdividing routes by state highway number, by pavement type, and by county.

C. Treatment Analysis

A methodology for interpreting distress data collected by the Pavement Distress Survey was developed last winter. The analysis is performed for a given highway section. From analysis of the data, the dominant distress governing treatment is identified. Also determined are the class of work, recommended treatment or alternatives, life expectancy, and estimated cost of treatment. This information is provided for pavements and also for shoulders (independent of pavements).

For a thorough discussion of the distress/treatment methodology, refer to the Technical Services Division preliminary report entitled A Systematic Method for Selecting a Pavement Repair Treatment Based on Distress Data, dated April 1987.

III. SURVEY FINDINGS

This chapter presents the findings of the 1986 Interstate Survey for Regions 1 through 10. Distress data on pavements and shoulders was collected during September and October. Methods were subsequently developed to analyze the survey data on a highway section basis to produce pavement and shoulder evaluations. The results are documented in individual Highway Section Reports (a sample report is included in Appendix B; for a detailed description of highway section evaluations refer to one of the regional reports entitled Interstate Highway System, Pavement Distress Survey Results). Information presented in tables and figures in this chapter is summarized from highway section evaluations.

Survey findings are presented in a manner that will help guide management of pavement-related resources. This chapter is divided into two main sections: "Overview -- Regions 1 through 10" and "Regional Comparisons". Information is provided on the amount, class, and cost of work to perform necessary pavement and shoulder repairs. The information is network-level, useful for describing condition of the highway system, setting goals, developing capital and maintenance programs, allocating funds, and monitoring progress toward stated goals.

The following terms are used to report survey findings:

Work Class - categorizes treatment actions primarily by cost, and secondarily by nature of work -- Major, Intermediate, and Minor Rehabilitation; Preventive Maintenance; and Do Nothing categories.

"Not Evaluated" refers to situations that did not warrant preparation of Highway Section Reports. Reasons vary -- highway sections or subsections were less than 0.3 miles in length, or less than three, tenth mile assessments were made, or the section could not be rated due to prevailing conditions (no shoulder, under construction, bridge, interchange, or other).

Route Miles is the length in one direction.

Lane Miles is the area of pavement surface for both directional roadways.

Cost (pavement) is estimated using average bid prices and quantity estimates for roadway sections having different lane configurations. Separate sets of costs have been developed for upstate regions (Regions 1 through 7 and 9), Region 8, and Region 10. Pavement costs are the product of roadway section-mile cost and section length. The cost is for pavement-related work only, including consequential shoulder work. Caution is advised when using these cost estimates. In some instances, ancillary work such as adjusting guiderail, installing signs, and correcting drainage deficiencies could double project costs.

Shoulder Miles is the length of outside shoulder for both directional roadways.

Cost (shoulders) is estimated using statewide average bid prices and an assumed roadway section having 4-ft inside and 10-ft outside shoulders. Costs are for shoulder work independent of pavement work needs.

A. Overview -- Regions 1 through 10

Pavement condition was assessed using the Pavement Distress Survey on 91 percent of the Interstate Highway System. Region 11 with 88 miles was not surveyed. Survey findings reported herein are for the ten-region system totaling 859 miles. Table 1 gives the distribution of Interstate mileage by route and county.

1. Pavement Evaluation

Most of New York's Interstate Highway System was constructed during the 1960s using reinforced concrete pavements. Research has determined that the average age of rigid pavements before first overlay is about 25 years. Therefore, a large portion of our Interstate system can be expected to require major rehabilitation, if not already performed. Currently, 58 percent of the mileage surveyed is rigid pavement, 16 percent overlay, and 26 percent flexible.

Table 2 reports the findings of the 1986 Interstate Survey. Work is broken down by class for each of three pavement types, with mileages and estimated costs. Totals are given for all pavement types as well.

Seventy-one percent of the 859 miles surveyed requires maintenance or rehabilitation work costing $196 million. Nineteen percent was "do nothing" and ten percent was "not evaluated." Twenty-six percent of our pavements are in "poor" condition, that is, in need of major rehabilitation. All but two miles requiring major rehabilitation are the rigid pavement type.

Not all work indicated need be done in a single construction season. A highway section will normally remain in an indicated work class for at least several years. From a network point-of-view, some sections may just be entering a particular work class, others may have already been there for several years, and still others may be about to move into the next, more costly work class. It is this latter group of highway sections that should be given priority, for work can no longer be deferred without incurring additional costs. Subsequent pavement surveys will provide information on deterioration patterns that will help identify these priority sections.

Figures 1 and 2 display information for "All" pavement types from Table 2. Pie charts help demonstrate the relative significance of preventive maintenance to other work classes -- less than 5 percent of the total work cost will address the needs of nearly 25 percent of the pavements. This

Table 1
REGIONAL MILEAGE DISTRIBUTION
1986 Interstate Survey
Regions 1 - 10

Region	County	Route	Route Miles	Lane Miles
1	Albany	87I	9.7	57.5
		90I	9.4	49.2
		787I	10.0	62.1
		890I	1.1	4.1
	Essex	87I	56.4	225.8
	Rensselaer	90I	17.2	86.3
		787I	0.3	1.7
	Saratoga	87I	34.8	208.5
	Schenectady	88I	14.7	70.8
		890I	8.2	46.9
	Warren	87I	39.9	195.4
	Subtotal		201.7	1008.3
2	Oneida	790I	2.6	7.4
	Subtotal		2.6	7.4
3	Cortland	81I	29.3	117.0
	Onondaga	81I	34.8	183.2
		481I	13.4	57.9
		690I	12.5	72.0
	Oswego	81I	25.7	117.4
		84I	5.2	20.8
	Subtotal		120.9	568.3
4	Genesee	490I	3.0	11.8
	Livingston	390I	36.6	146.2
	Monroe	390I	18.0	93.0
		490I	33.2	163.9
		590I	5.2	24.0
	Ontario	490I	1.6	6.6
	Subtotal		97.5	445.5
5	Erie	290I	9.8	56.8
		990I	3.8	20.8
	Niagara	190I	6.6	26.4
	Subtotal		20.2	104.0

Table 1 (continued)
REGIONAL MILEAGE DISTRIBUTION
1986 Interstate Survey
Regions 1 - 10

Region	County	Route	Route Miles	Lane Miles
6	Steuben	390I	21.1	84.2
	Subtotal		21.1	84.2
7	Clinton	87I	37.8	156.2
	Jefferson	81I	53.4	208.1
	Subtotal		91.2	364.3
8	Dutchess	84I	15.8	61.4
	Orange	84I	40.3	159.8
	Putnam	84I	15.5	62.2
		684I	2.5	14.7
	Rockland	287I	0.4	1.8
	Ulster	587I	1.2	4.8
	Westchester	287I	10.2	59.8
		684I	25.7	146.6
	Subtotal		111.6	511.1
9	Broome	81I	35.9	153.0
		88I	16.5	66.0
	Chenango	88I	13.1	52.4
	Delaware	88I	12.4	49.8
	Otsego	81I	5.8	23.4
		88I	33.1	132.4
	Schoharie	88I	19.1	78.8
	Subtotal		135.9	555.8
10	Nassau	495I	16.9	101.4
	Suffolk	495I	39.5	236.7
	Subtotal		56.4	338.1
Grand Total (32 Counties)			859.1	3987.0

Table 2
INTERSTATE WORK SUMMARY
Regions 1 Through 10
Based On
The 1986 Interstate Survey

Pavement Distress Evaluation

Regions	Pavt. Type	Work Class	Route Miles	Route Miles %	Lane Miles	Cost $(M)
1-10	Rigid	Do Nothing	5	1	19	0.0
		Prev.Maint.	123	25	550	7.6
		Minor Rehab.	9	2	52	2.5
		Interm.Rehab.	87	17	428	33.7
		Major Rehab.	224	45	1065	128.9
		Not Evaluated	52	10	245	0.0
		Total	499	100	2358	172.8
1-10	Overlay					
		Do Nothing	61	44	311	0.0
		Prev.Maint.	43	31	216	0.7
		Minor Rehab.	11	8	58	3.6
		Interm.Rehab.	4	3	17	1.3
		Major Rehab.	0	0	0	0.0
		Not Evaluated	19	14	94	0.0
		Total	139	100	696	5.6
1-10	Flexible					
		Do Nothing	98	44	405	0.0
		Prev.Maint.	44	20	198	0.6
		Minor Rehab.	57	26	230	13.0
		Interm.Rehab.	9	4	40	2.8
		Major Rehab.	2	1	8	0.8
		Not Evaluated	12	5	53	0.0
		Total	221	100	934	17.2
1-10	All					
		Do Nothing	164	19	735	0.0
		Prev.Maint.	210	24	963	9.0
		Minor Rehab.	77	9	340	19.1
		Interm.Rehab.	100	12	485	37.8
		Major Rehab.	226	26	1073	129.7
		Not Evaluated	82	10	392	0.0
		Grand Total	859	100	3987	195.6

Figure 1. CLASSIFICATION OF PAVEMENT WORK

3987 Lane Miles Surveyed

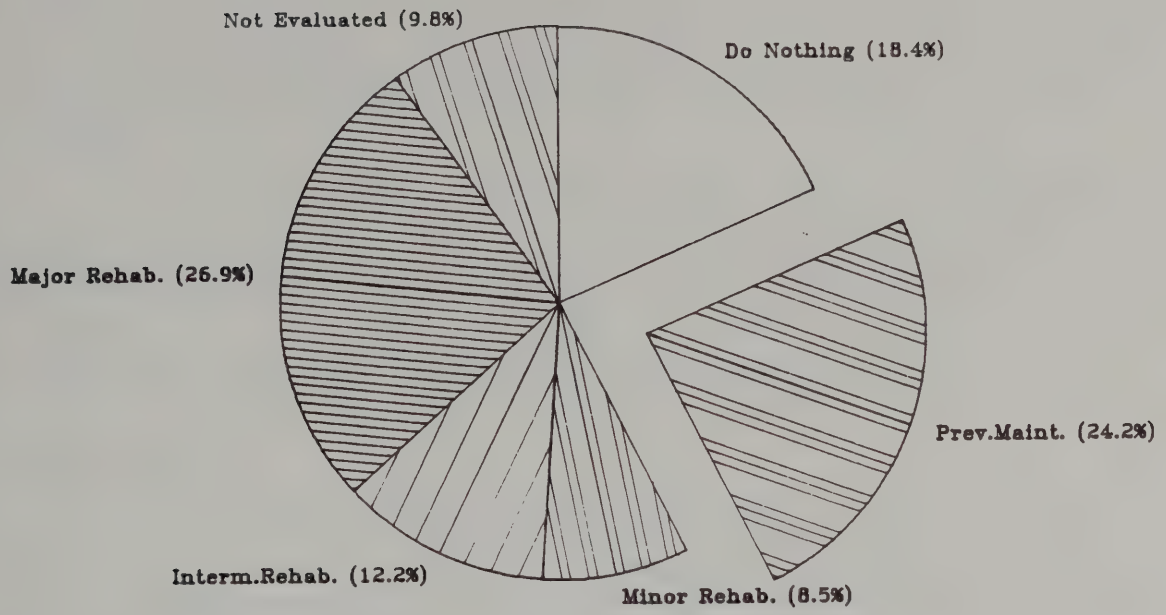
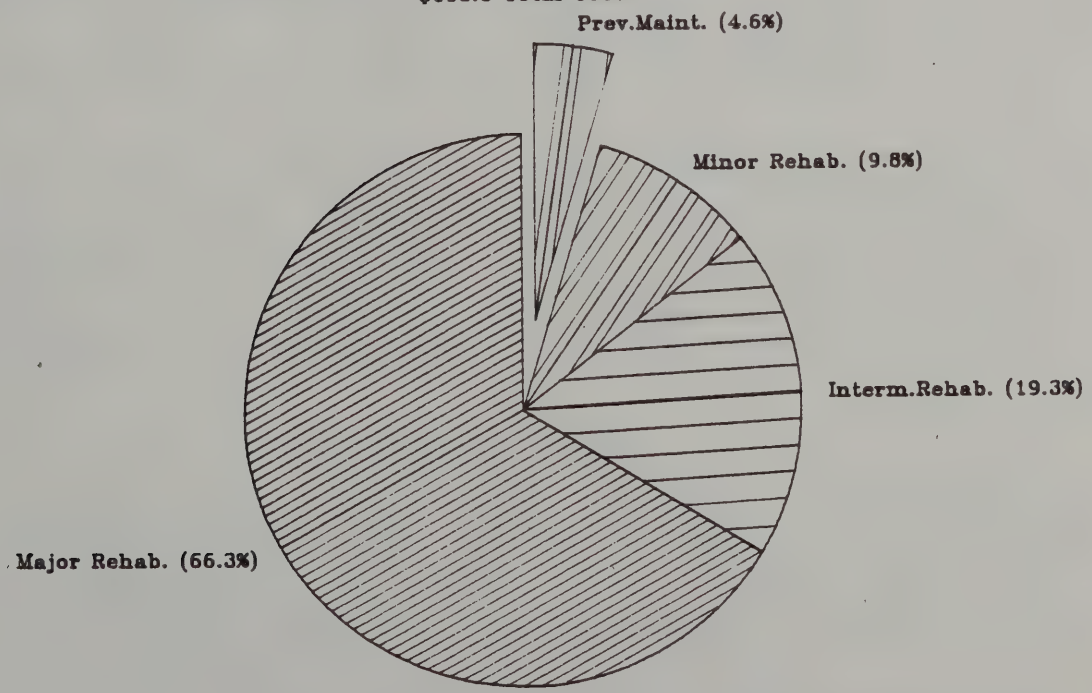


Figure 2. BREAKDOWN OF PAVEMENT WORK COSTS

$195.6 Total Cost



contrasts with 66 percent of the cost required to rehabilitate 27 percent of the mileage in "poor" condition (major rehabilitation). While preventive maintenance treatments appear resource-efficient, life cycle costs of treatments must be considered before judgments can be made on cost-effectiveness.

Figures 3 and 4 compare amount of work (lane-miles) and costs by work class for the three pavement types. Rigid pavements will require the greatest investment in the near future due to their age and the fact they comprise 58 percent of the network. Once rehabilitated, however, they will become overlay pavements which have a different deterioration pattern, sequence, and rate. Any pavement condition forecasting model would have to make allowances for the transition in pavement type.

2. Shoulder Evaluation

Shoulders were assessed on the Interstate Highway System in Regions 1 through 10 in a systematic and uniform manner using the Pavement Distress Survey. Survey findings are perhaps somewhat more favorable than might be, due to rating conventions used. Only the portion of shoulder falling within the wheelpath of the rating vehicle is rated, or if less, that portion which is currently being maintained. Shoulders maintained at widths below design width (usually 10-ft) were not downgraded. Surveyors were not instructed to record locations having substandard shoulders.

Table 3 provides summary information on shoulder condition and work needs. A description of distress scales used to rate shoulder condition can be found in Appendix A. A "distorted" shoulder would not be inviting to the motorist, whereas a "disintegrated" shoulder would be usable but rough-riding. Amounts of work in shoulder-miles and estimated costs are given for each work class. Total cost of shoulder work is $10.3 million.

Shoulder condition information from Table 3 is shown in pie chart format in Figure 5. Cracking in shoulders is very common (63%) and indicates a need for sealing, which is a preventive maintenance action. Figures 6 and 7 examine the information on work needs. The preventive maintenance dollar goes three times farther than the minor rehabilitation dollar. A preventive maintenance program for sealing cracked shoulders would reduce infiltration of water and slow the growth of minor rehabilitation needs.

B. Regional Comparisons

Survey findings in this section are reported by region to give a geographical perspective to work needs and costs. Information in this form is useful for dividing maintenance and rehabilitation programs into regional shares according to a needs based strategy for addressing pavement deterioration. Regional goals can be set and funding distributed accordingly. Subsequent surveys would provide feedback on program progress and effectiveness.

Table 4 is a more detailed presentation of information in Tables 2 and 3. Regional shares of mileage and work costs are given. Costs are for pavement-

Figure 3. CLASSIFICATION OF WORK BY PAVEMENT TYPE

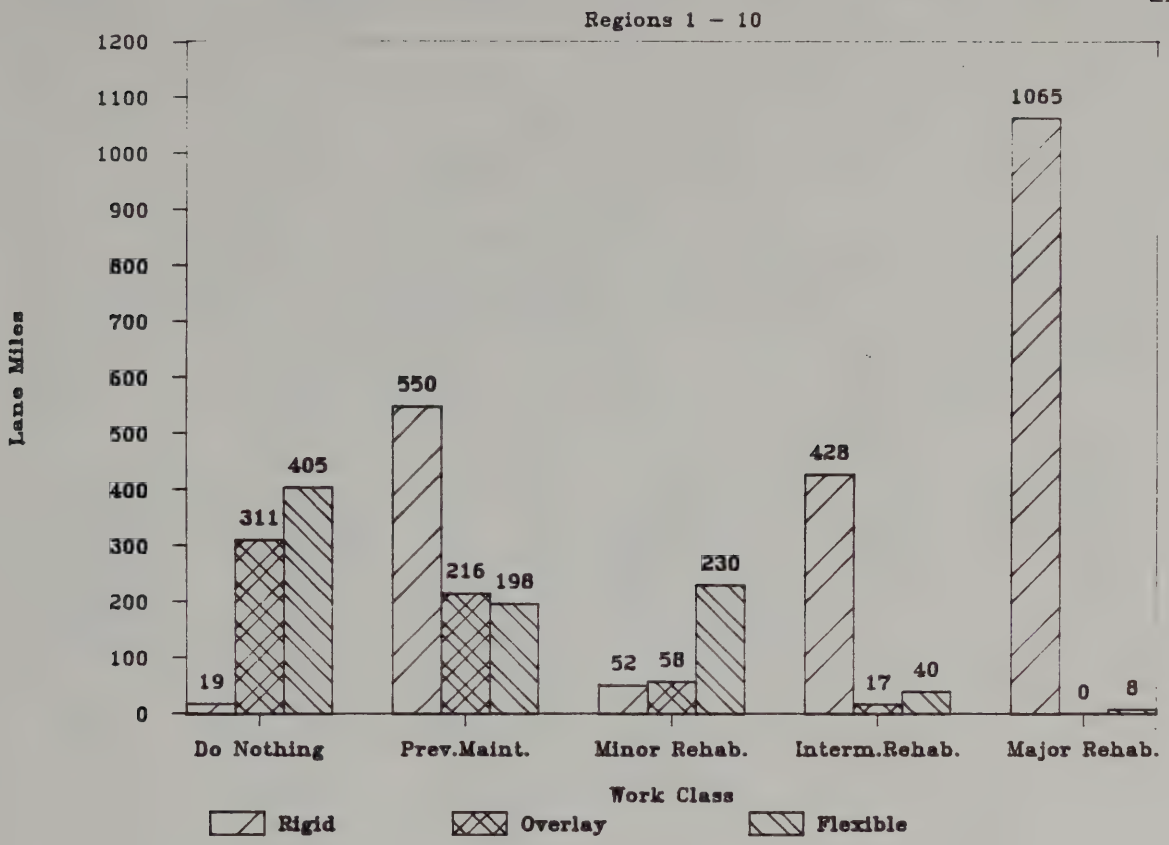


Figure 4. COST OF WORK BY PAVEMENT TYPE

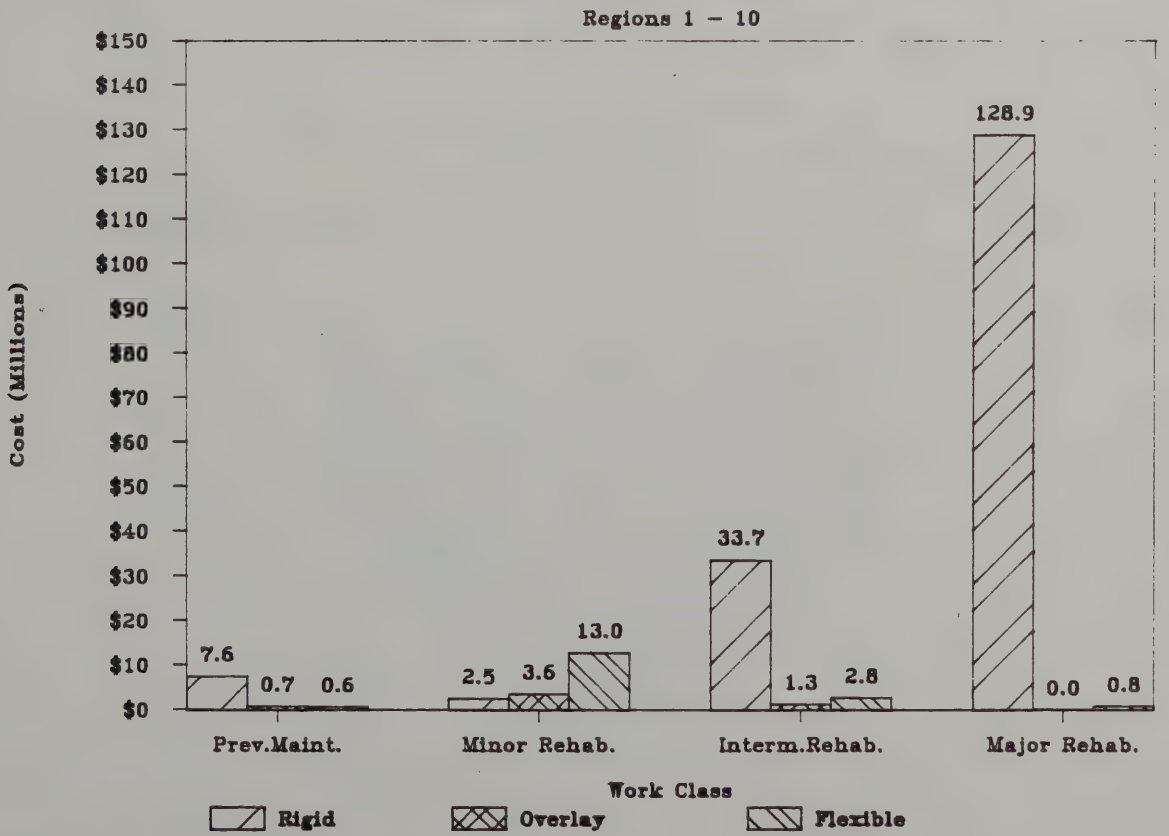


Table 3
INTERSTATE WORK SUMMARY
Regions 1 Through 10
Based On
The 1986 Interstate Survey

Shoulder Distress Evaluation

Distress Type	Shldr. Miles 2-way	Shldr. Miles %
Distorted	5	0
Disintegrated	300	17
Cracked	1080	63
Dropoff>2"	0	0
Insignificant	168	10
Not Evaluated	165	10
Total	1718	100

Work Class	Shldr. Miles 2-way	Shldr. Miles %	Cost $(M)
Do Nothing	228	13	$0.0
Prev.Maint.	1020	59	$4.7
Minor Rehab.	300	17	$5.3
Major Rehab.	5	0	$0.3
Not Evaluated	165	10	$0.0
Total	1718	100	$10.3

Figure 5. INTERSTATE SHOULDER CONDITION
1718 Shoulder Miles Surveyed

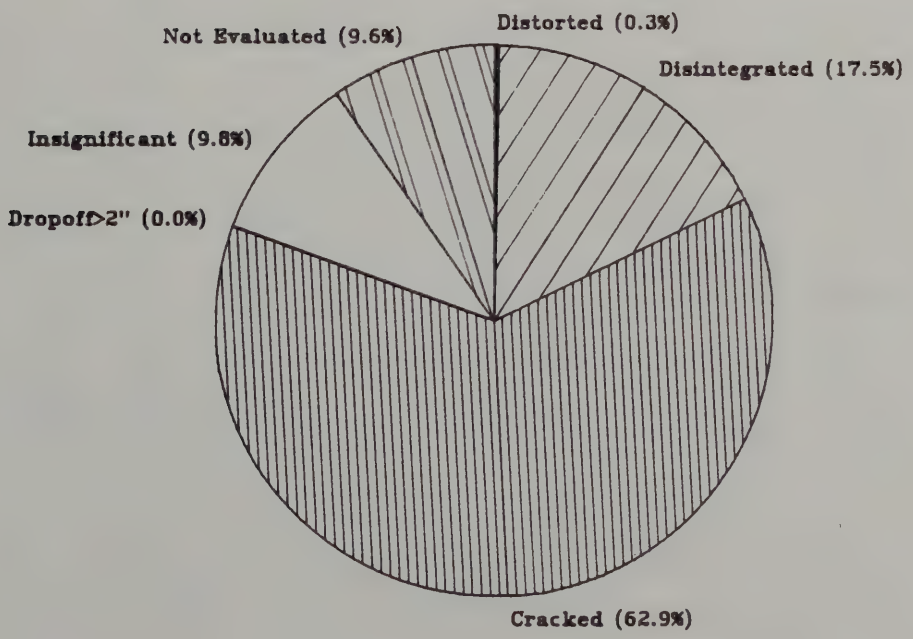


Figure 6. CLASSIFICATION OF SHOULDER WORK
1718 Shoulder Miles Surveyed

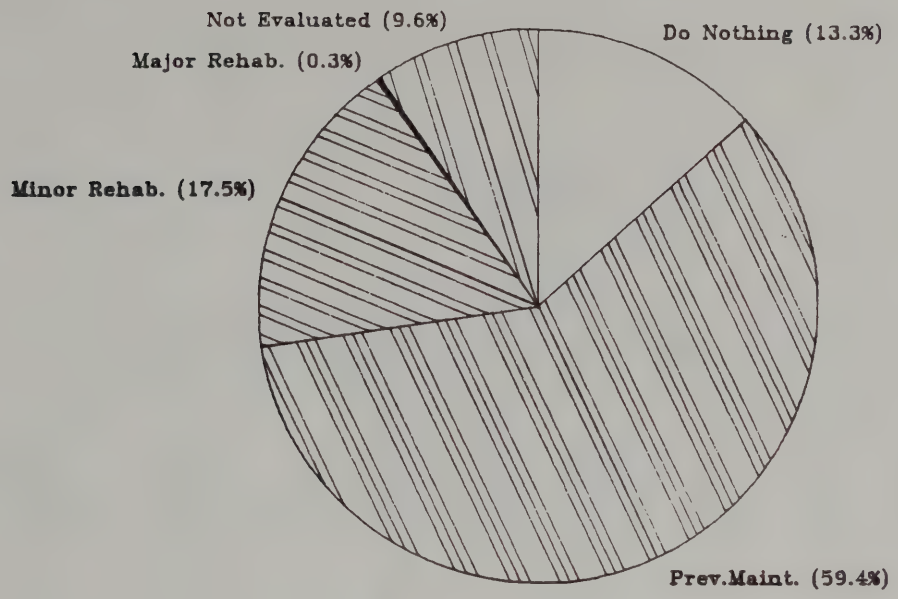


Figure 7. BREAKDOWN OF SHOULDER WORK COSTS
$10.3 M Total Cost

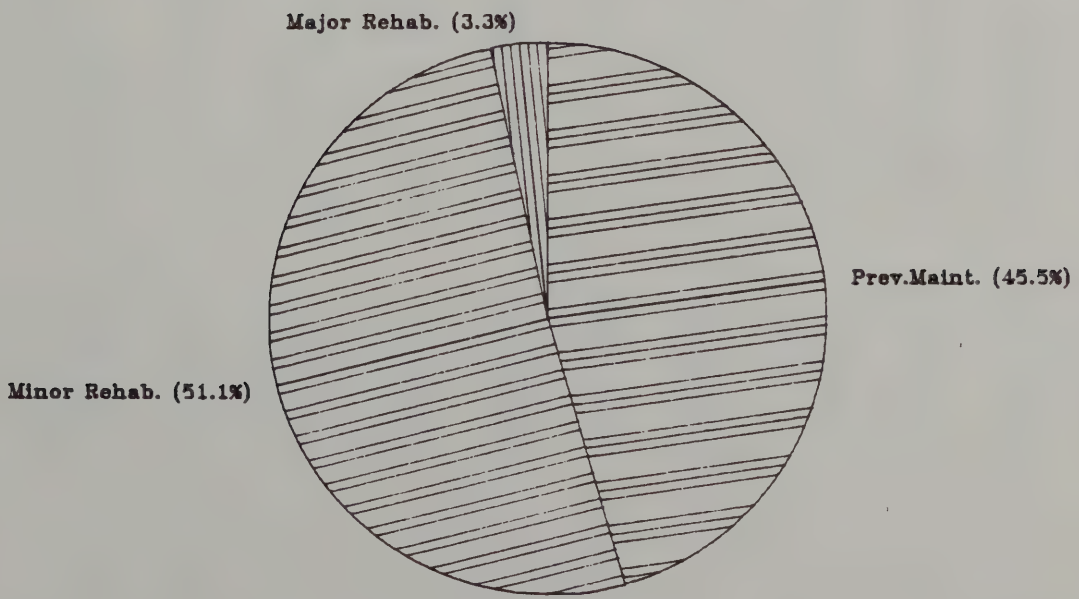


Table 4
1986 INTERSTATE SURVEY
Regional Work Summaries
Based On
Pavement Distress Survey and Analysis

		REGION 1	REGION 2	REGION 3	REGION 4	REGION 5	REGION 6	REGION 7	REGION 8	REGION 9	REGION 10	TOTAL
Rigid	Route Miles	90.3	1.3	39.3	78.1	19.5	16.9	0.0	104.7	109.0	39.7	498.8
	Lane Miles	504.3	2.6	177.0	349.2	101.4	67.4	0.0	470.8	446.8	238.2	2357.7
	Work Cost($M)	24.739	0.000	11.761	21.222	9.080	5.295	0.000	56.288	23.174	21.205	172.764
Overlay	Route Miles	23.2	1.3	59.5	3.7	0.4	4.2	10.0	7.0	13.1	16.7	139.1
	Lane Miles	135.7	4.8	287.5	17.0	2.2	16.8	38.4	40.3	53.0	99.9	695.6
	Work Cost($M)	0.941	0.000	1.239	0.006	0.000	1.306	0.134	0.000	0.817	1.178	5.621
Flexible	Route Miles	88.3	0	22.1	15.6	0.2	0.0	81.3	0.0	13.9	0.0	221.4
	Lane Miles	368.4	0	103.8	79.3	0.4	0.0	325.9	0.0	56.0	0.0	933.8
	Work Cost($M)	10.229	0.000	1.917	2.805	0.000	0.000	2.238	0.000	0.000	0.000	17.189
Pavement	Route Miles	201.8	2.6	120.9	97.4	20.1	21.1	91.3	111.7	136.0	56.4	859.3
	Lane Miles	1008.4	7.4	568.3	445.5	104.0	84.2	364.3	511.1	555.8	338.1	3987.1
	Prev.Maint.($M)	2.565	0.000	0.627	1.547	0.233	0.161	0.421	0.187	2.849	0.404	8.994
	Minor Rehab.($M)	10.770	0.000	2.604	0.737	0.000	0.000	1.951	0.000	0.956	2.101	19.119
	Interm.Rehab.($M)	6.398	0.000	0.173	3.313	0.171	3.033	0.000	7.927	9.124	7.650	37.789
	Major Rehab.($M)	16.176	0.000	11.513	18.436	8.676	3.407	0.000	48.174	11.062	12.228	129.672
	Work Cost ($M)	35.909	0.000	14.917	24.033	9.080	6.601	2.372	56.288	23.991	22.383	195.574
	% Total Cost	18.4	0.0	7.6	12.3	4.6	3.4	1.2	28.8	12.3	11.4	100.0
Shoulder	Shld.Miles	403.3	5.2	241.7	195.0	40.4	42.1	182.4	223.5	272.0	112.7	1718.3
	Prev.Maint.($M)	0.982	0.000	0.737	0.402	0.047	0.178	0.372	0.375	1.121	0.476	4.690
	Minor Rehab.($M)	0.774	0.000	0.264	1.206	0.312	0.229	0.000	1.595	0.814	0.075	5.269
	Major Rehab.($M)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.345	0.000	0.000	0.345
	Work Cost ($M)	1.756	0.000	1.001	1.608	0.359	0.407	0.372	2.315	1.935	0.551	10.304
	% Total Cost	17.0	0.0	9.7	15.6	3.5	3.9	3.6	22.5	18.8	5.3	100.0

and shoulder-related work only and do not include costs for ancillary work, which could be substantial. Regional percentages of total cost for pavement and shoulder work are also included in Table 4.

Another way to study the work needs of the Interstate Highway System is by route. Summary listings can be found in Appendix C which organizes survey findings in this manner. Work class amounts and costs are given by region for each route. The distribution of work for a route gives clues to overall pavement condition and age.

In this chapter, an attempt has been made to present survey findings in ways meaningful to administrators and managers having interest in the Interstate Highway System. The 1986 Interstate Survey gives a snapshot of pavement and shoulder condition never before obtained. Distresses have been documented at tenth mile intervals and summarized for highway sections to describe particular modes of failure. Standard treatments have been identified for the various combinations of distresses, along with treatment costs and life expectancies. Groups of similarly priced treatments give classes of work describing needs at the network level.

What is missing is a series of snapshots that describe the dynamics of change. Subsequent pavement distress surveys will accomplish this. Data collected will provide a systematic basis for determining cost effectiveness of treatments and pavement designs, in addition to an understanding of how pavements deteriorate. Then we can focus on the issue of work priorities.

IV. USE OF THE 1986 INTERSTATE SURVEY RESULTS

This chapter provides information that will determine the proper uses of Interstate Survey information presented in this report. Consideration is given to survey methodology, data analysis procedures, validity of assumptions, and precision of variables.

Highway Section Reports and regional and statewide summaries provide technical information not now available in the Department's pavement management process. This information is intended to influence complex decisions regarding the management of pavement resources -- not to dictate solutions. Proper application of the Interstate Survey findings should lead to a more systematic, cost-effective approach to pavement management.

The Pavement Distress Survey and treatment methodology provide the following advantages:

-- Engineering data on the condition of pavements and shoulders at the network level.

-- Uniform documentation of pavement distress across regional boundaries.

-- Uniform statewide interpretation of distress data using a computer software treatment-selection matrix.

-- Most current maintenance and rehabilitation treatments incorporated in the analytical software.

-- Use of current, weighted average bid prices, which are geographically sensitive.

-- Uniform maintenance treatments statewide for a given pavement or shoulder condition.

-- Distress assessments on both directional roadways of a divided highway.

This information also has the following shortcomings:

-- Inherent inaccuracies common to subjective surveys.

-- Use of only six pavement distresses to evaluate pavement work needs.

-- Documentation of distresses in driving lane and outside shoulder only.

-- No consideration for other pavement characteristics -- roughness, friction, and structural capacity.

-- One-time survey -- no prediction and deterioration rates unless repeated.

-- No assessment of drainage.

-- Limitations of Sufficiency File data base -- no truck axle loadings, maintenance histories, or pavement performance factors.

-- Scope limited to pavement and shoulder work needs, with no consideration of other highway needs.

-- Scope limited to the identification of work that can be budgeted and scheduled, as opposed to "demand-maintenance" work.

ACKNOWLEDGMENTS

This project is the responsibility of the Pavement Management Section of the Technical Services Division and is being conducted under the general supervision of Gerald Perregaux, Pavement Management Engineer. The 2-1/2 year long project includes development of a pavement distress survey, implementation of the survey on the Interstate Highway System, and analysis of the survey data. Many persons have been involved with this project at one time or another providing valuable assistance. Those that warrant special acknowledgment for their contribution of time, knowledge, or expertise are listed here in chronological order.

Lyndon Moore, former Director of Technical Services Division, introduced the Department to the concepts and principles of pavement management. As a proponent of pavement distress surveys, he was instrumental in making this project a reality.

Geoff Wood of the Engineering Research and Development Bureau prepared a comprehensive document entitled Pavement Distress Survey Manual which describes distresses and methods of measurement in detail.

Fred Hiss, Assistant Director of the Engineering Research and Development Bureau, obtained resident engineer information on pavement distresses and produced a detailed distress survey requiring physical measurements.

Professor Dimitri Grivas, a consultant, introduced the concepts of linguistic distress survey scales, "fuzzy set" mathematical analyses, and expert systems. He provided invaluable guidance and structure to development of the survey during its early stages.

Jack Vyce of the Engineering Research and Development Bureau provided considerable assistance in developing distress scales for the survey by sharing his extensive knowledge of distresses and their measurement. Peter Bellair, also of Engineering Research, provided consultation and staff support.

William Cuerdon of the Pavement Management Section oversaw field activities involved in development of distress scales and was responsible for much of the analysis and documentation. Also joining the team on temporary assignment were Dave Richards of the Materials Bureau and Dave Ingalls and Ross Alexander of the Soil Mechanics Bureau. This group conducted training sessions for the survey teams and provided the standard against which assessments by other teams were judged. Amy Hyland of the Pavement Management Section also assisted in development of distress scales.

The following personnel conducted pavement surveys during the pilot phases of the project: Ed Bikowitz, Mark Flynn, Bob Longint, Jeff McCullough, Jim Noonan, and Dick Wright of the Engineering Research and Development Bureau; Dave Richards of the Materials Bureau; and Kevin Eager and Paul Kucerak of the Soil Mechanics Bureau.

Bill Bord, Region 1's Safety Representative, prepared the section on safety in the Pavement Distress Survey Manual and presented a session on safety at the training session for survey crews.

John Shufon of the Data Services Bureau was largely responsible for conducting the Interstate Survey. He and his staff recruited survey personnel, arranged for survey vehicles and support, designed and printed the survey form, provided data collection and editing services, and merged the distress survey data with the Highway Sufficiency file. John is to be commended for his diligent efforts under severe time and resource constraints. Fred Neveu prepared the mainframe computer program for merging distress survey data with the highway sufficiency data into a combined file.

The Highway Maintenance and Equipment Management Divisions provided support services for the Interstate Survey. Special recognition goes to Ray Oliver who arranged for survey vehicles and to Frank Trendell for arranging safety backup vehicles.

Survey teams for the Interstate Survey were comprised of personnel drawn from many sections of the Department. Participating in the survey were: Jack Albertine, John Divirgilio, and Tom O'Hare from Region 1 Planning; Tim Lusher, Region 2 Planning; Mat Patla, Region 3 Construction; Gerald Spencer, Region 4 Construction; Richard Owarczak, Region 5 Design; Steve Hall, Region 6 Design; Jim Bevens, Region 7 Construction; Mark Sagar, Region 8 Planning; Tom Beirut, Region 9 Design; Wadith Isdith, Region 10 Design; Tom Baldowski, Gloria Jillson, Brian Kirch from Main Office Data Services Bureau -- a total of 15 surveyors.

The Engineering Research and Development Bureau provided all support required for computer programming. Mike Fitzpatrick developed programs in BASIC for reporting distress survey data. He also provided dBASE programs that created and manipulated survey data. Gerry Anania provided all the BASIC programming required in the latter stages of the project. He downloaded mainframe files to microcomputers, automated the reporting process, and provided numerous enhancements to the analytical program, including regional cost factors and highway subsection plotting capability.

Wayne Brule, Assistant Director of the Materials Bureau, chaired a task force which produced the methodology for interpreting distress information into treatment actions. This critical step permitted survey data to be reported in a meaningful format to users.

APPENDIX A

Pavement Distress Survey Scales

RIGID PAVEMENT DISTRESS SCALES

TRANSVERSE JOINT FAULTING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
OBVIOUS (>1/2")	1-2 JOINTS	LI
	>2 JOINTS	LG

TRANSVERSE JOINT SEAL		
SEVERITY	EXTENT	LEVEL
NONE	—	N
ANY OR ALL OF SEAL(S) MISSING	1-2 JOINTS	LI
	>2 JOINTS	LG

TRANSVERSE JOINT SPALLING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
<3" WIDE, ANY PORTION OF JOINT	1-2 JOINTS	SI
	>2 JOINTS	SG
>3" WIDE, <1/2 JOINT LENGTH	1-2 JOINTS	MI
	>2 JOINTS	MG
>3" WIDE, >1/2 JOINT LENGTH	1-2 JOINTS	LI
	>2 JOINTS	LG
FULL-WIDTH CUT, REMOVED AND PATCHED	1-2 JOINTS	TI
	>2 JOINTS	TG

SLAB CRACKING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
TIGHT	1-2 SLABS	SI
	>2 SLABS	SG
OPEN	1-2 SLABS	MI
	>2 SLABS	MG
WIDE, SPALLED, AND/OR FAULTED	1-2 SLABS	LI
	>2 SLABS	LG
BROKEN SLAB	1-2 SLABS	TI
	>2 SLABS	TG

LONGITUDINAL JOINT SPALLING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
<6" WIDE	1-2 SLABS	SI
	>2 SLABS	SG
6"-10" WIDE	1-2 SLABS	MI
	>2 SLABS	MG
>10" WIDE	1-2 SLABS	LI
	>2 SLABS	LG

SURFACE DETERIORATION		
SEVERITY	EXTENT	LEVEL
NONE	—	N
PITTING	1-2 SLABS	SI
	>2 SLABS	SG
FEW (<3) SPALLS	1-2 SLABS	MI
	>2 SLABS	MG
NUMEROUS (>3) SPALLS	1-2 SLABS	LI
	>2 SLABS	LG

FLEXIBLE/OVERLAY PAVEMENT DISTRESS SCALES

CENTERLINE CRACKING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
TIGHT	OCCASIONAL	SI
	FREQUENT	SG
OPEN/ MULTIPLE	OCCASIONAL	MI
	FREQUENT	MG
ALLIGATORED ONLY	OCCASIONAL	LI
	FREQUENT	LG
ALLIGATORED WITH MAT'L LOSS	OCCASIONAL	TI
	FREQUENT	TG

LONGITUDINAL CRACKING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
TIGHT	OCCASIONAL	SI
	FREQUENT	SG
OPEN/ MULTIPLE	OCCASIONAL	MI
	FREQUENT	MG
ALLIGATORED ONLY	OCCASIONAL	LI
	FREQUENT	LG
ALLIGATORED WITH MAT'L LOSS	OCCASIONAL	TI
	FREQUENT	TG

EDGE CRACKING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
TIGHT	OCCASIONAL	SI
	FREQUENT	SG
OPEN/ MULTIPLE	OCCASIONAL	MI
	FREQUENT	MG
ALLIGATORED ONLY	OCCASIONAL	LI
	FREQUENT	LG
ALLIGATORED WITH MAT'L LOSS	OCCASIONAL	TI
	FREQUENT	TG

TRANSVERSE CRACKING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
TIGHT	OCCASIONAL	SI
	FREQUENT	SG
OPEN/ MULTIPLE	OCCASIONAL	MI
	FREQUENT	MG
ALLIGATORED ONLY	OCCASIONAL	LI
	FREQUENT	LG
ALLIGATORED WITH MAT'L LOSS	OCCASIONAL	TI
	FREQUENT	TG

RAVELING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
BINDER LOSS	OCCASIONAL	SI
	FREQUENT	SG
AGGREGATE LOSS	OCCASIONAL	MI
	FREQUENT	MG
AGGREGATE LOSS TO POTHOLED CONDITION	OCCASIONAL	LI
	FREQUENT	LG

RUTTING		
SEVERITY	EXTENT	LEVEL
NONE	—	N
OBVIOUS >1"	OCCASIONAL	SI
	FREQUENT	SG

SHOULDER DISTRESS SCALES

SHOULDER CONDITION		
SEVERITY	EXTENT	LEVEL
NONE	—	N
CRACKING	OCCASIONAL	SI
	FREQUENT	SG
SURFACE MATERIAL LOSS	OCCASIONAL	MI
	FREQUENT	MG
DISTORTION	OCCASIONAL	LI
	FREQUENT	LG

LANE/SHOULDER DROPOFF		
SEVERITY	EXTENT	LEVEL
NONE	—	N
<1″	OCCASIONAL	SI
	FREQUENT	SG
1″-2″	OCCASIONAL	MI
	FREQUENT	MG
>2″	OCCASIONAL	LI
	FREQUENT	LG

APPENDIX B

Highway Section Report

HIGHWAY SECTION
REPORT

ROUTE 90I
SHNO 71-1

Eastbound
FROM: 90I-1402-2027
TO: 90I-1402-2065

SECTION 1 OF 1

COUNTY	Rensselaer	YEAR CONSTRUCTED	1971
SECTION LENGTH	3.8 Miles	PAVEMENT TYPE.....	Rigid
LENGTH WITH DATA...	3.5 Miles	YEAR OF LAST WORK	1973
NUMBER OF LANES....	3	TYPE OF WORK	
SURVEY DATE	Fall 1986		

PAVEMENT ANALYSIS

PRIMARY DISTRESS... Transverse spalls <1/2 joint long and >3 in. wide
CLASS OF WORK..... Minor Rehabilitation
ESTIMATED COST..... 533000
RECOMMENDED TREATMENT OR ALTERNATIVES

Type	Cost	Life(Yrs.)
Patch spalls/grind faults/reseal joints	533000	5

Note- shoulder work is not included in cost estimate

SHOULDER ANALYSIS

PRIMARY DISTRESS... Disintegrated surface- gravel like
CLASS OF REPAIR.... Minor Rehabilitation
ESTIMATED COST..... 67000
RECOMMENDED TREATMENT

Type	Cost	Life(Yrs.)
1 in. Overlay	67000	7

ROUTE 90I
SHNO 71-1

Eastbound
FROM: 90I-1402-2027
TO: 90I-1402-2065

SECTION 1 OF 1

PERCENT OF SECTION LENGTH AFFECTED
BY TYPE AND DEGREE OF DISTRESS

Distress	NN	SI	SG	MI	MG	LI	LG	TI	TG
Trans.Jt.Seal	0	0	0	0	0	23	77	0	0
Tran.Jt.Fault	54	0	0	0	0	23	23	0	0
Trans.Jt.Spall	29	57	9	3	0	3	0	0	0
Long.Jt.Spall	57	9	3	17	0	14	0	0	0
Surface Deter.	23	40	6	31	0	0	0	0	0
Slab Cracking	6	23	43	0	0	29	0	0	0
Shld.Condition	0	11	57	11	20	0	0	0	0
Shld.Dropoff	11	43	29	9	3	6	0	0	0

CUMULATIVE PERCENT
OF SECTION LENGTH AFFECTED
BY TYPE AND DEGREE OF DISTRESS

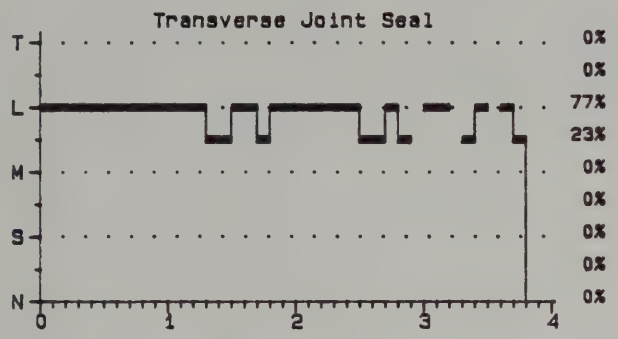
Distress	NN	SI	SG	MI	MG	LI	LG	TI	TG
Trans.Jt.Seal	100	100	100	100	100	100	77	0	0
Tran.Jt.Fault	100	46	46	46	46	46	23	0	0
Trans.Jt.Spall	101	72	15	6	3	3	0	0	0
Long.Jt.Spall	100	43	34	31	14	14	0	0	0
Surface Deter.	100	77	37	31	0	0	0	0	0
Slab Cracking	101	95	72	29	29	29	0	0	0
Shld.Condition	99	99	88	31	20	0	0	0	0
Shld.Dropoff	101	90	47	18	9	6	0	0	0

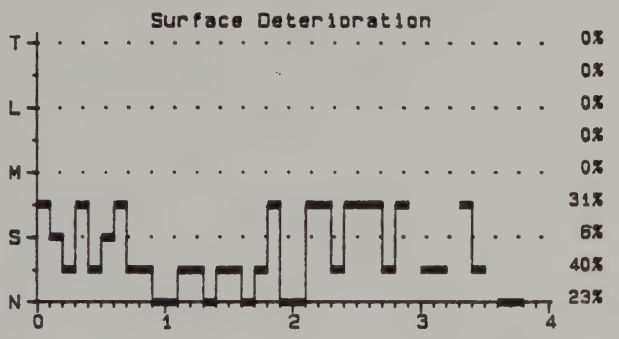
Effective % of Transverse Spalls = 2

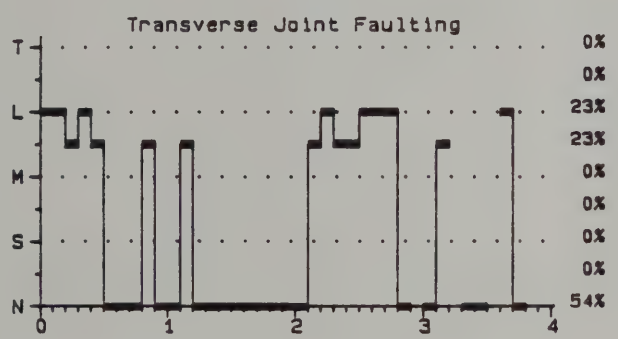
Effective % of Slab Cracking= 15

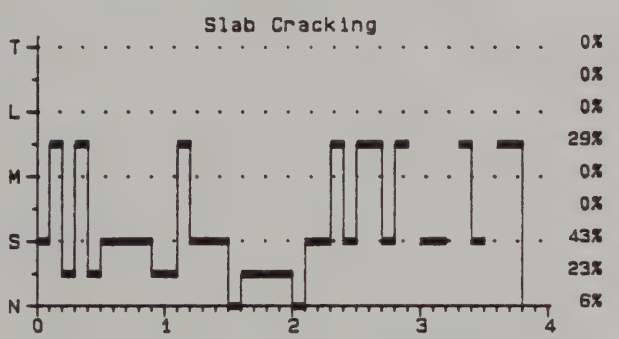
ROUTE NO. 90I
SH NO. 71-1
SECTION ..... 1 OF 1
COUNTY ..... Rensselaer
BEG.REF.NO. 90I-1402-2027
END REF.NO. 90I-1402-2065
DIRECTION ..... Eastbound

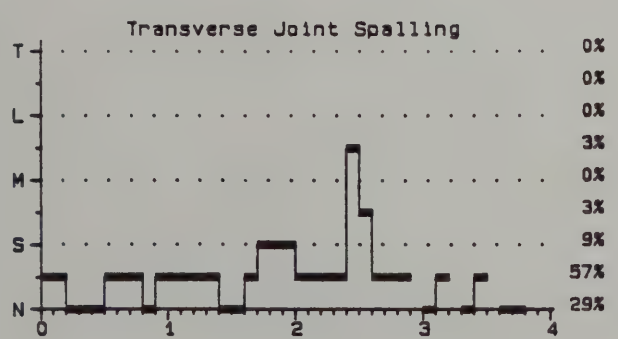
NUMBER OF LANES 3
SECTION LENGTH ..... 3.8 Miles
YEAR CONSTRUCTED 1971
PAVEMENT TYPE ..... Rigid
YEAR OF LAST WORK ... 1973
TYPE OF WORK .....
SURVEY DATE ..... Fall 1986

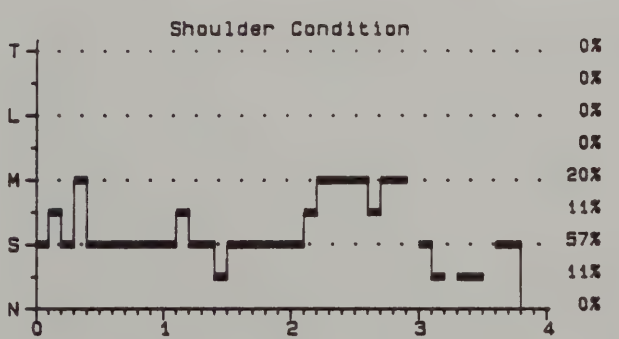


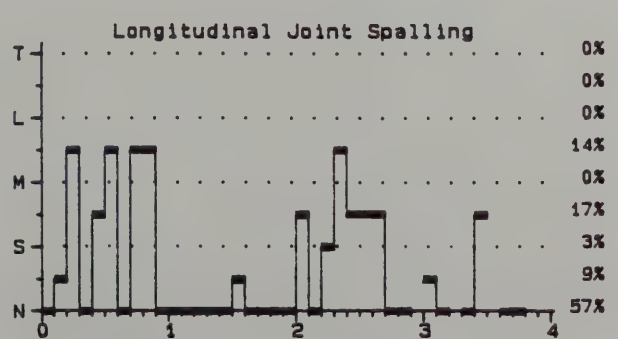


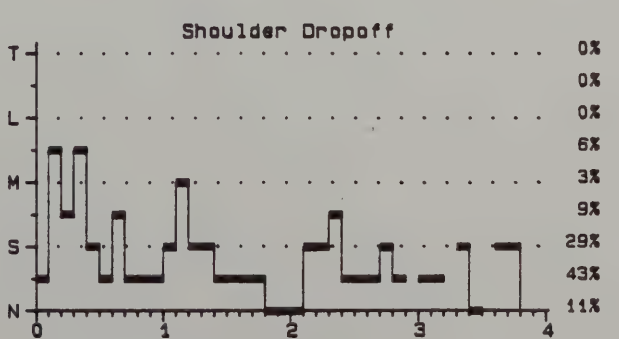












APPENDIX C

Work Summaries By Route and By Region

Pavement Work

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->1

ROUTE	WORK CLASS	LANE MILES	COST
87	Do Nothing	177.1	0
87	Preventive Maintenance	138.4	774000
87	Minor Rehabilitation	168.5	9479000
87	Intermediate Rehabilitation	45.7	2943000
87	Major Rehabilitation	131.0	12686000
87	Not Evaluated	26.5	0
	Subtotal by Route	687.2	25882000
88	Do Nothing	0.0	0
88	Preventive Maintenance	70.8	995000
88	Minor Rehabilitation	0.0	0
88	Intermediate Rehabilitation	0.0	0
88	Major Rehabilitation	0.0	0
88	Not Evaluated	0.0	0
	Subtotal by Route	70.8	995000
90	Do Nothing	5.6	0
90	Preventive Maintenance	29.2	321000
90	Minor Rehabilitation	27.6	1291000
90	Intermediate Rehabilitation	16.2	1096000
90	Major Rehabilitation	8.2	824000
90	Not Evaluated	48.7	0
	Subtotal by Route	135.5	3532000

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->1

ROUTE	WORK CLASS	LANE MILES	COST
787	Do Nothing	0.0	0
787	Preventive Maintenance	25.9	387000
787	Minor Rehabilitation	0.0	0
787	Intermediate Rehabilitation	17.7	1121000
787	Major Rehabilitation	12.6	1210000
787	Not Evaluated	7.6	0
	Subtotal by Route	63.8	2718000
890	Do Nothing	0.0	0
890	Preventive Maintenance	6.6	88000
890	Minor Rehabilitation	0.0	0
890	Intermediate Rehabilitation	20.6	1238000
890	Major Rehabilitation	15.1	1456000
890	Not Evaluated	8.7	0
	Subtotal by Route	51.0	2782000

****

PAVEMENT WORK TOTALS --- REGION 1

Do Nothing	182.7	0
Preventive Maintenance	270.9	2565000
Minor Rehabilitation	196.1	10770000
Intermediate Rehabilitation	100.2	6398000
Major Rehabilitation	166.9	16176000
Not Evaluated	91.5	0
Totals for all work classes	1008	35909000

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->2

ROUTE	WORK CLASS	LANE MILES	COST
790	Do Nothing	0.0	0
790	Preventive Maintenance	0.0	0
790	Minor Rehabilitation	0.0	0
790	Intermediate Rehabilitation	0.0	0
790	Major Rehabilitation	0.0	0
790	Not Evaluated	7.4	0
	Subtotal by Route	7.4	0

****

PAVEMENT WORK TOTALS --- REGION 2

Do Nothing	0.0	0
Preventive Maintenance	0.0	0
Minor Rehabilitation	0.0	0
Intermediate Rehabilitation	0.0	0
Major Rehabilitation	0.0	0
Not Evaluated	7.4	0
Totals for all work classes	7.4	0

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->3

ROUTE	WORK CLASS	LANE MILES	COST
81	Do Nothing	135.7	0
81	Preventive Maintenance	62.9	389000
81	Minor Rehabilitation	31.0	1677000
81	Intermediate Rehabilitation	0.0	0
81	Major Rehabilitation	104.4	11513000
81	Not Evaluated	83.6	0
	Subtotal by Route	417.6	13579000
84	Do Nothing	20.8	0
84	Preventive Maintenance	0.0	0
84	Minor Rehabilitation	0.0	0
84	Intermediate Rehabilitation	0.0	0
84	Major Rehabilitation	0.0	0
84	Not Evaluated	0.0	0
	Subtotal by Route	20.8	0
481	Do Nothing	17.8	0
481	Preventive Maintenance	24.5	82000
481	Minor Rehabilitation	15.0	831000
481	Intermediate Rehabilitation	0.0	0
481	Major Rehabilitation	0.0	0
481	Not Evaluated	0.6	0
	Subtotal by Route	57.9	913000

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->3

ROUTE	WORK CLASS	LANE MILES	COST
690	Do Nothing	0.0	0
690	Preventive Maintenance	51.8	156000
690	Minor Rehabilitation	1.6	96000
690	Intermediate Rehabilitation	2.7	173000
690	Major Rehabilitation	0.0	0
690	Not Evaluated	15.9	0
	Subtotal by Route	72.0	425000

****

PAVEMENT WORK TOTALS --- REGION 3

Do Nothing	174.3	0
Preventive Maintenance	139.2	627000
Minor Rehabilitation	47.6	2604000
Intermediate Rehabilitation	2.7	173000
Major Rehabilitation	104.4	11513000
Not Evaluated	100.1	0
Totals for all work classes	568.3	14917000

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->4

ROUTE	WORK CLASS	LANE MILES	COST
390	Do Nothing	42.4	0
390	Preventive Maintenance	109.4	1466000
390	Minor Rehabilitation	13.0	737000
390	Intermediate Rehabilitation	34.6	2449000
390	Major Rehabilitation	23.6	2670000
390	Not Evaluated	16.2	0
	Subtotal by Route	239.2	7322000
490	Do Nothing	0.0	0
490	Preventive Maintenance	5.1	75000
490	Minor Rehabilitation	0.0	0
490	Intermediate Rehabilitation	5.1	323000
490	Major Rehabilitation	149.3	15766000
490	Not Evaluated	22.8	0
	Subtotal by Route	182.3	16164000
590	Do Nothing	0.0	0
590	Preventive Maintenance	2.4	6000
590	Minor Rehabilitation	0.0	0
590	Intermediate Rehabilitation	8.0	541000
590	Major Rehabilitation	0.0	0
590	Not Evaluated	13.6	0
	Subtotal by Route	24.0	547000

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->4

****

PAVEMENT WORK TOTALS --- REGION 4

Do Nothing	42.4	0
Preventive Maintenance	116.9	1547000
Minor Rehabilitation	13.0	737000
Intermediate Rehabilitation	47.7	3313000
Major Rehabilitation	172.9	18436000
Not Evaluated	52.6	0
Totals for all work classes	445.5	24033000

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->5

ROUTE	WORK CLASS	LANE MILES	COST
190	Do Nothing	0.0	0
190	Preventive Maintenance	0.0	0
190	Minor Rehabilitation	0.0	0
190	Intermediate Rehabilitation	0.0	0
190	Major Rehabilitation	23.8	3064000
190	Not Evaluated	2.6	0
	Subtotal by Route	26.4	3064000
290	Do Nothing	0.0	0
290	Preventive Maintenance	0.0	0
290	Minor Rehabilitation	0.0	0
290	Intermediate Rehabilitation	0.0	0
290	Major Rehabilitation	55.6	5612000
290	Not Evaluated	1.2	0
	Subtotal by Route	56.8	5612000
990	Do Nothing	1.5	0
990	Preventive Maintenance	16.2	233000
990	Minor Rehabilitation	0.0	0
990	Intermediate Rehabilitation	2.7	171000
990	Major Rehabilitation	0.0	0
990	Not Evaluated	0.4	0
	Subtotal by Route	20.8	404000

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->5

****

PAVEMENT WORK TOTALS --- REGION 5

Do Nothing	1.5	0
Preventive Maintenance	16.2	233000
Minor Rehabilitation	0.0	0
Intermediate Rehabilitation	2.7	171000
Major Rehabilitation	79.4	8676000
Not Evaluated	4.2	0
Totals for all work classes	104.0	9080000

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->6

ROUTE	WORK CLASS	LANE MILES	COST
390	Do Nothing	0.0	0
390	Preventive Maintenance	12.0	161000
390	Minor Rehabilitation	0.0	0
390	Intermediate Rehabilitation	40.4	3033000
390	Major Rehabilitation	31.8	3407000
390	Not Evaluated	0.0	0
	Subtotal by Route	84.2	6601000

****

PAVEMENT WORK TOTALS --- REGION 6

Do Nothing	0.0	0
Preventive Maintenance	12.0	161000
Minor Rehabilitation	0.0	0
Intermediate Rehabilitation	40.4	3033000
Major Rehabilitation	31.8	3407000
Not Evaluated	0.0	0
Totals for all work classes	84.2	6601000

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->7

ROUTE	WORK CLASS	LANE MILES	COST
81	Do Nothing	64.0	0
81	Preventive Maintenance	96.2	333000
81	Minor Rehabilitation	34.4	1951000
81	Intermediate Rehabilitation	0.0	0
81	Major Rehabilitation	0.0	0
81	Not Evaluated	13.5	0
	Subtotal by Route	208.1	2284000
87	Do Nothing	130.2	0
87	Preventive Maintenance	26.0	88000
87	Minor Rehabilitation	0.0	0
87	Intermediate Rehabilitation	0.0	0
87	Major Rehabilitation	0.0	0
87	Not Evaluated	0.0	0
	Subtotal by Route	156.2	88000

****

PAVEMENT WORK TOTALS --- REGION 7

Do Nothing	194.2	0
Preventive Maintenance	122.2	421000
Minor Rehabilitation	34.4	1951000
Intermediate Rehabilitation	0.0	0
Major Rehabilitation	0.0	0
Not Evaluated	13.5	0
Totals for all work classes	364.3	2372000

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->8

ROUTE	WORK CLASS	LANE MILES	COST
84	Do Nothing	0.0	0
84	Preventive Maintenance	0.0	0
84	Minor Rehabilitation	0.0	0
84	Intermediate Rehabilitation	37.2	3388000
84	Major Rehabilitation	236.4	33819000
84	Not Evaluated	9.8	0
	Subtotal by Route	283.4	37207000
287	Do Nothing	0.0	0
287	Preventive Maintenance	0.0	0
287	Minor Rehabilitation	0.0	0
287	Intermediate Rehabilitation	0.0	0
287	Major Rehabilitation	55.2	6867000
287	Not Evaluated	6.4	0
	Subtotal by Route	61.6	6867000
587	Do Nothing	0.0	0
587	Preventive Maintenance	0.0	0
587	Minor Rehabilitation	0.0	0
587	Intermediate Rehabilitation	0.0	0
587	Major Rehabilitation	4.8	630000
587	Not Evaluated	0.0	0
	Subtotal by Route	4.8	630000

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->8

ROUTE	WORK CLASS	LANE MILES	COST
684	Do Nothing	35.1	0
684	Preventive Maintenance	12.0	187000
684	Minor Rehabilitation	0.0	0
684	Intermediate Rehabilitation	57.6	4539000
684	Major Rehabilitation	53.6	6858000
684	Not Evaluated	3.0	0
	Subtotal by Route	161.3	11584000

****

PAVEMENT WORK TOTALS --- REGION 8

Do Nothing	35.1	0
Preventive Maintenance	12.0	187000
Minor Rehabilitation	0.0	0
Intermediate Rehabilitation	94.8	7927000
Major Rehabilitation	350.0	48174000
Not Evaluated	19.2	0
Totals for all work classes	511.1	56288000

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->9

ROUTE	WORK CLASS	LANE MILES	COST
81	Do Nothing	10.2	0
81	Preventive Maintenance	51.2	409000
81	Minor Rehabilitation	12.0	722000
81	Intermediate Rehabilitation	0.0	0
81	Major Rehabilitation	84.3	10119000
81	Not Evaluated	18.7	0
	Subtotal by Route	176.4	11250000
88	Do Nothing	54.2	0
88	Preventive Maintenance	182.6	2440000
88	Minor Rehabilitation	5.0	234000
88	Intermediate Rehabilitation	125.6	9124000
88	Major Rehabilitation	8.8	943000
88	Not Evaluated	3.2	0
	Subtotal by Route	379.4	12741000

****

PAVEMENT WORK TOTALS --- REGION 9

Do Nothing	64.4	0
Preventive Maintenance	233.8	2849000
Minor Rehabilitation	17.0	956000
Intermediate Rehabilitation	125.6	9124000
Major Rehabilitation	93.1	11062000
Not Evaluated	21.9	0
Totals for all work classes	555.8	23991000

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->

ROUTE	WORK CLASS	LANE MILES	COST

1986 INTERSTATE SURVEY

PAVEMENT WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION ---> 10

ROUTE	WORK CLASS	LANE MILES	COST
495	Do Nothing	39.9	0
495	Preventive Maintenance	40.2	404000
495	Minor Rehabilitation	32.1	2101000
495	Intermediate Rehabilitation	70.5	7650000
495	Major Rehabilitation	74.1	12228000
495	Not Evaluated	81.3	0
	Subtotal by Route	338.1	22383000

****

PAVEMENT WORK TOTALS --- REGION 10

Do Nothing	39.9	0
Preventive Maintenance	40.2	404000
Minor Rehabilitation	32.1	2101000
Intermediate Rehabilitation	70.5	7650000
Major Rehabilitation	74.1	12228000
Not Evaluated	81.3	0
Totals for all work classes	338.1	22383000

Shoulder Work

1986 INTERSTATE SURVEY

SHOULDER WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->1

ROUTE	WORK CLASS	SHOULDER MILES	COST
87	Do Nothing	22.7	0
87	Preventive Maintenance	212.5	606000
87	Minor Rehabilitation	35.0	616000
87	Major Rehabilitation	0.0	0
87	Not Evaluated	11.5	0
	Subtotal by Route	281.7	1222000
88	Do Nothing	0.0	0
88	Preventive Maintenance	29.4	179000
88	Minor Rehabilitation	0.0	0
88	Major Rehabilitation	0.0	0
88	Not Evaluated	0.0	0
	Subtotal by Route	29.4	179000
90	Do Nothing	5.6	0
90	Preventive Maintenance	20.1	92000
90	Minor Rehabilitation	7.6	134000
90	Major Rehabilitation	0.0	0
90	Not Evaluated	19.9	0
	Subtotal by Route	53.2	226000

1986 INTERSTATE SURVEY

SHOULDER WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->1

ROUTE	WORK CLASS	SHOULDER MILES	COST
787	Do Nothing	0.4	0
787	Preventive Maintenance	16.2	95000
787	Minor Rehabilitation	1.4	24000
787	Major Rehabilitation	0.0	0
787	Not Evaluated	2.5	0
	Subtotal by Route	20.5	119000
890	Do Nothing	12.9	0
890	Preventive Maintenance	1.7	10000
890	Minor Rehabilitation	0.0	0
890	Major Rehabilitation	0.0	0
890	Not Evaluated	3.9	0
	Subtotal by Route	18.5	10000

****

SHOULDER WORK TOTALS --- REGION 1

Do Nothing	41.6	0
Preventive Maintenance	279.9	982000
Minor Rehabilitation	44.0	774000
Major Rehabilitation	0.0	0
Not Evaluated	37.8	0
Totals for all work classes	403.3	1756000

1986 INTERSTATE SURVEY

SHOULDER WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->2

ROUTE	WORK CLASS	SHOULDER MILES	COST
790	Do Nothing	0.0	0
790	Preventive Maintenance	0.0	0
790	Minor Rehabilitation	0.0	0
790	Major Rehabilitation	0.0	0
790	Not Evaluated	5.2	0
	Subtotal by Route	5.2	0

****

SHOULDER WORK TOTALS --- REGION 2

Do Nothing	0.0	0
Preventive Maintenance	0.0	0
Minor Rehabilitation	0.0	0
Major Rehabilitation	0.0	0
Not Evaluated	5.2	0
Totals for all work classes	5.2	0

1986 INTERSTATE SURVEY

SHOULDER WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->3

ROUTE	WORK CLASS	SHOULDER MILES	COST
81	Do Nothing	37.3	0
81	Preventive Maintenance	88.6	488000
81	Minor Rehabilitation	15.1	264000
81	Major Rehabilitation	0.0	0
81	Not Evaluated	38.5	0
	Subtotal by Route	179.5	752000
84	Do Nothing	0.0	0
84	Preventive Maintenance	10.4	19000
84	Minor Rehabilitation	0.0	0
84	Major Rehabilitation	0.0	0
84	Not Evaluated	0.0	0
	Subtotal by Route	10.4	19000
481	Do Nothing	0.0	0
481	Preventive Maintenance	26.2	134000
481	Minor Rehabilitation	0.0	0
481	Major Rehabilitation	0.0	0
481	Not Evaluated	0.6	0
	Subtotal by Route	26.8	134000

1986 INTERSTATE SURVEY

SHOULDER WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->3

ROUTE	WORK CLASS	SHOULDER MILES	COST
690	Do Nothing	0.0	0
690	Preventive Maintenance	19.3	96000
690	Minor Rehabilitation	0.0	0
690	Major Rehabilitation	0.0	0
690	Not Evaluated	5.7	0
	Subtotal by Route	25.0	96000

****

SHOULDER WORK TOTALS --- REGION 3

Do Nothing	37.3	0
Preventive Maintenance	144.5	737000
Minor Rehabilitation	15.1	264000
Major Rehabilitation	0.0	0
Not Evaluated	44.8	0
Totals for all work classes	241.7	1001000

1986 INTERSTATE SURVEY

SHOULDER WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->4

ROUTE	WORK CLASS	SHOULDER MILES	COST
390	Do Nothing	21.5	0
390	Preventive Maintenance	71.6	374000
390	Minor Rehabilitation	10.5	185000
390	Major Rehabilitation	0.0	0
390	Not Evaluated	5.5	0
	Subtotal by Route	109.1	559000
490	Do Nothing	6.6	0
490	Preventive Maintenance	3.5	20000
490	Minor Rehabilitation	58.4	1021000
490	Major Rehabilitation	0.0	0
490	Not Evaluated	7.0	0
	Subtotal by Route	75.5	1041000
590	Do Nothing	0.4	0
590	Preventive Maintenance	3.6	8000
590	Minor Rehabilitation	0.0	0
590	Major Rehabilitation	0.0	0
590	Not Evaluated	6.4	0
	Subtotal by Route	10.4	8000

****

SHOULDER WORK TOTALS --- REGION 4

Do Nothing	28.5	0
Preventive Maintenance	78.7	402000
Minor Rehabilitation	68.9	1206000
Major Rehabilitation	0.0	0
Not Evaluated	18.9	0
Totals for all work classes	195.0	1608000

1986 INTERSTATE SURVEY

SHOULDER WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->5

ROUTE	WORK CLASS	SHOULDER MILES	COST
190	Do Nothing	0.0	0
190	Preventive Maintenance	0.8	4000
190	Minor Rehabilitation	11.1	195000
190	Major Rehabilitation	0.0	0
190	Not Evaluated	1.3	0
	Subtotal by Route	13.2	199000
290	Do Nothing	10.0	0
290	Preventive Maintenance	2.5	15000
290	Minor Rehabilitation	6.7	117000
290	Major Rehabilitation	0.0	0
290	Not Evaluated	0.4	0
	Subtotal by Route	19.6	132000
990	Do Nothing	2.1	0
990	Preventive Maintenance	5.1	28000
990	Minor Rehabilitation	0.0	0
990	Major Rehabilitation	0.0	0
990	Not Evaluated	0.4	0
	Subtotal by Route	7.6	28000

****

SHOULDER WORK TOTALS --- REGION 5

Do Nothing	12.1	0
Preventive Maintenance	8.4	47000
Minor Rehabilitation	17.8	312000
Major Rehabilitation	0.0	0
Not Evaluated	2.1	0
Totals for all work classes	40.4	359000

1986 INTERSTATE SURVEY

SHOULDER WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->6

ROUTE	WORK CLASS	SHOULDER MILES	COST
390	Do Nothing	0.0	0
390	Preventive Maintenance	29.1	178000
390	Minor Rehabilitation	13.0	229000
390	Major Rehabilitation	0.0	0
390	Not Evaluated	0.0	0
	Subtotal by Route	42.1	407000

****

SHOULDER WORK TOTALS --- REGION 6

Do Nothing	0.0	0
Preventive Maintenance	29.1	178000
Minor Rehabilitation	13.0	229000
Major Rehabilitation	0.0	0
Not Evaluated	0.0	0
Totals for all work classes	42.1	407000

1986 INTERSTATE SURVEY

SHOULDER WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->7

ROUTE	WORK CLASS	SHOULDER MILES	COST
81	Do Nothing	7.9	0
81	Preventive Maintenance	90.2	248000
81	Minor Rehabilitation	0.0	0
81	Major Rehabilitation	0.0	0
81	Not Evaluated	8.7	0
	Subtotal by Route	106.8	248000
87	Do Nothing	5.5	0
87	Preventive Maintenance	70.1	124000
87	Minor Rehabilitation	0.0	0
87	Major Rehabilitation	0.0	0
87	Not Evaluated	0.0	0
	Subtotal by Route	75.6	124000

****

SHOULDER WORK TOTALS --- REGION 7

Do Nothing	13.4	0
Preventive Maintenance	160.3	372000
Minor Rehabilitation	0.0	0
Major Rehabilitation	0.0	0
Not Evaluated	8.7	0
Totals for all work classes	182.4	372000

1986 INTERSTATE SURVEY

SHOULDER WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->8

ROUTE	WORK CLASS	SHOULDER MILES	COST
84	Do Nothing	29.9	0
84	Preventive Maintenance	23.1	143000
84	Minor Rehabilitation	79.1	1390000
84	Major Rehabilitation	4.7	345000
84	Not Evaluated	6.5	0
	Subtotal by Route	143.3	1878000
287	Do Nothing	0.0	0
287	Preventive Maintenance	9.1	56000
287	Minor Rehabilitation	9.3	163000
287	Major Rehabilitation	0.0	0
287	Not Evaluated	2.9	0
	Subtotal by Route	21.3	219000
587	Do Nothing	0.0	0
587	Preventive Maintenance	0.0	0
587	Minor Rehabilitation	2.4	42000
587	Major Rehabilitation	0.0	0
587	Not Evaluated	0.0	0
	Subtotal by Route	2.4	42000

1986 INTERSTATE SURVEY

SHOULDER WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->8

ROUTE	WORK CLASS	SHOULDER MILES	COST
684	Do Nothing	26.9	0
684	Preventive Maintenance	28.4	176000
684	Minor Rehabilitation	0.0	0
684	Major Rehabilitation	0.0	0
684	Not Evaluated	1.2	0
	Subtotal by Route	56.5	176000

****

SHOULDER WORK TOTALS --- REGION 8

Do Nothing	56.8	0
Preventive Maintenance	60.6	375000
Minor Rehabilitation	90.8	1595000
Major Rehabilitation	4.7	345000
Not Evaluated	10.6	0
Totals for all work classes	223.5	2315000

1986 INTERSTATE SURVEY

SHOULDER WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION --->9

ROUTE	WORK CLASS	SHOULDER MILES	COST
81	Do Nothing	5.1	0
81	Preventive Maintenance	47.7	296000
81	Minor Rehabilitation	22.6	396000
81	Major Rehabilitation	0.0	0
81	Not Evaluated	8.1	0
	Subtotal by Route	83.5	692000
88	Do Nothing	30.0	0
88	Preventive Maintenance	133.1	825000
88	Minor Rehabilitation	23.8	418000
88	Major Rehabilitation	0.0	0
88	Not Evaluated	1.6	0
	Subtotal by Route	188.5	1243000

****

SHOULDER WORK TOTALS --- REGION 9

Do Nothing	35.1	0
Preventive Maintenance	180.8	1121000
Minor Rehabilitation	46.4	814000
Major Rehabilitation	0.0	0
Not Evaluated	9.7	0
Totals for all work classes	272.0	1935000

1986 INTERSTATE SURVEY

SHOULDER WORK SUMMARY
WORK CLASS BY ROUTE BY REGION
BASED ON PAVEMENT DISTRESS EVALUATION

REGION ---> 10

ROUTE	WORK CLASS	SHOULDER MILES	COST
495	Do Nothing	3.4	0
495	Preventive Maintenance	77.9	476000
495	Minor Rehabilitation	4.3	75000
495	Major Rehabilitation	0.0	0
495	Not Evaluated	27.1	0
	Subtotal by Route	112.7	551000

****

SHOULDER WORK TOTALS --- REGION 10

Do Nothing	3.4	0
Preventive Maintenance	77.9	476000
Minor Rehabilitation	4.3	75000
Major Rehabilitation	0.0	0
Not Evaluated	27.1	0
Totals for all work classes	112.7	551000

00984 00684
LRI